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THE CHANGING NATURE OF JAPANESE MANUFACTURING

Summary

The economic world knows Japan mainly through its manufactured products. And companies such as Toyota Motor Corp. and Sony Corp. are the best known. This report, based mostly on the latest (1985) Japanese census of manufactures, is the story of how these companies fit into the broader mosaic of Japanese manufacturing. Just as there are winners and losers among companies, some Japanese industries have been more successful than others.

The era of the high yen as well as internal dynamics continue to pose new challenges for Japanese manufacturers. Firms are seeking opportunities where they can find them, venturing increasingly into manufacturing abroad or into new activities at home. These changes promise to keep the structure of Japanese manufacturing fluid and dynamic.

Trends in Industrial Structure

Manufacturing looms large in the Japanese economy but it is not of overwhelming importance. During the postwar period it has never employed more than about one-third of the non-agricultural labor force, reaching a peak of 32 percent in 1970 before drifting downward. In recent years manufacturing employment has remained a stable percentage of total employment (see Table 1).

A remarkably large number of locations are involved in manufacturing activity in Japan. The data in Table 1 refer only to those workplaces where at least four people are employed but there are still almost half a million such locations. Furthermore, this striking characteristic of Japanese manufacturing

shows few signs of changing. Different ways of collecting the data make comparisons difficult, but the number of manufacturing workplaces employing 10 or more people increased from 163,487 in 1967 to 184,923 in 1985. In 1985 a Japanese worker was more likely to work in a factory employing fewer than 10 people than in one employing more than 1,000.

Table 1: Trends in Manufacturing Employment and Output, 1975-85

	Number of Workplaces*	Employment	Percent of Total Employment	Shipments (million yen)	Percent of Value-Added**	Shipment Volume Index (1981=100)
1975	430,491	10,660,000	25.5%	Y125,841,000	25.9%	74.5
1981	436,463	10,567,601	24.8	224,711,947	29.5	100.0
1982	427,998	10,480,985	24.5	229,934,044	30.3	99.3
1983	446,942	10,650,971	24.5	235,526,868	31.7	102.8
1984	428,998	10,733,413	24.9	253,029,814	33.7	111.8
1985	438,518	10,889,949	25.0	265,320,551	35.0	115.8

*Data refer to workplaces employing at least four people.
**Value-added in manufacturing as percent of gross domestic product.

Sources: Ministry of International Trade and Industry, Census of Manufactures: Report by Industries, 1985, for establishment, employment and shipment data; Managment and Coordination Agency, Labor Force Survey, for labor force data; Economic Planning Agency, Annual Report on National Accounts, for percent of value-added in manufacturing; and Ministry of International Trade and Industry, Industrial Statistics Monthly, for shipment index.

Table 1 also shows another striking result. While the number of manufacturing establishments was virtually unchanged between 1981 and 1985 and the number of workers increased by only 3.1 percent, shipments increased by 15.8 percent after adjusting for inflation, further evidence of the already well-known increase in Japan's manufacturing productivity. An almost constant proportion of the labor force was able to produce a rising percentage of the economy's total output as measured by value-added -- the difference between the costs of raw materials and intermediate inputs and sales at each stage of production. In a sense, Japan's experience has a parallel in the United States, where for years manufacturing has been relatively stable as a percentage of output but falling as a percentage of total employment.

Between 1981 and 1985 the relative importance of various kinds of manufacturing changed in Japan, as Table 2 shows. Generally, highly capital-intensive industries such as petroleum refining and steel declined in relative importance and sometimes in absolute terms. For example, employment in petroleum refining dropped more than 15 percent while output declined 19 percent in

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current yen and 15 percent adjusted for price changes. On the other hand, electric machinery employment was up 24 percent and output expanded 31 percent in yen terms or 25 percent in real terms. The result: petroleum refining dropped from 7.1 percent of manufacturing as measured by shipments to 4.9 percent and electric machinery rose by four percentage points to 15.4 percent.

Table 2: Changes in Industry Composition, 1981-85*

	1981	1982	1983	1984	1985
Food Products	7.9%	8.1%	8.3%	8.0%	7.7%
Tobacco Products, Beverages and Feed	2.8	2.9	2.9	2.8	3.2
Textile Mill Products	3.6	3.6	3.4	3.2	3.0
Apparel and Made-up Textile Products	1.4	1.4	1.4	1.3	1.4
Lumber and Wood Products	1.2	1.9	1.8	1.6	1.5
Furniture and Fixtures	1.3	1.3	1.2	1.1	1.1
Pulp, Paper and Paper Products	3.0	3.0	3.0	2.9	2.8
Printing and Publishing	3.3	3.4	3.5	3.3	3.4
Chemicals and Related Products	8.0	8.0	8.2	8.0	7.7
Petroleum Refining	7.1	6.9	6.1	5.4	4.9
Plastic Products	2.6	2.7	2.8	3.0	3.0
Rubber Products	1.1	1.1	1.1	1.1	1.1
Leather and Leather Products	0.5	0.4	0.4	0.4	0.4
Nonmetallic Mineral Products	3.8	3.7	3.7	3.5	3.3
Steel	7.7	7.6	6.8	6.8	6.7
Nonferrous Metals	3.2	2.9	2.9	2.8	2.4
Fabricated Metal Products	4.9	4.9	4.8	4.7	5.0
Nonelectric Machinery	8.6	8.7	8.6	8.8	9.1
Electric Machinery	11.4	12.0	13.4	15.4	15.4
Transportation Equipment	12.5	12.5	12.6	12.7	13.6
Precision Instruments	1.7	1.6	1.6	1.6	1.7
Ordnance**	0.0	0.0	0.0	0.0	0.0
Other	1.5	1.5	1.5	1.5	1.5

*Based on value of shipments.
**Less than 0.1 percent each year.

Source: Ministry of International Trade and Industry, Census of Manufactures, 1985.

Table 3 combines the 21 industries of Table 2 into three categories developed by the Ministry of International Trade and Industry. A glance at the broad groupings of basic industries, processing and fabricating, and consumer-oriented and other industries shows that the first group rose between 1975 and 1979 and then contracted through 1985; the processing and fabricating category declined, then increased; while the third group declined slowly. Basic industries are especially energy-intensive and part of their relative decline in the 1980s may have been a reaction to the jump in oil prices in the late 1970s, although the decline continued into the mid-1980s in the face of falling real prices for petroleum.

Table 3: Trends by Industry Groups, 1975-85

(percent of total value-added in manufacturing)

	Basic Industries	Processing and Fabricating Industries	Other Industries
1975	39.6%	33.3%	27.0%
1976	39.3	34.4	26.4
1977	39.2	34.7	26.1
1978	40.2	33.5	26.3
1979	42.1	32.9	25.0
1980	41.3	34.4	24.2
1981	39.0	36.3	24.6
1982	38.3	37.0	24.7
1983	37.2	38.1	24.7
1984	37.1	39.4	23.5
1985	36.4	40.3	23.2

Note: Basic industries include lumber and wood products; pulp, paper and paper products; chemicals and related products; petroleum and coal products; plastic products; rubber products; nonmetallic mineral products; steel; nonferrous metals; and fabricated metal products.

Processing and fabricating industries include nonelectric machinery, electric machinery, transportation equipment and precision instruments.

Other industries include food products; tobacco products, beverages, and feed; textile mill products; apparel and made-up textile products; furniture and fixtures; printing and publishing; leather and leather products; and other manufacturing.

Source: Ministry of International Trade and Industry, Census of Manufactures: Report by Industries, 1985, pp. 18-19.

Evaluating Value-Added

Some experts believe that as the Japanese economy matures, manufacturers emphasize increasingly sophisticated products that involve more specialized labor skills and highlight the identities of the companies producing them, enabling producers to build more profit into their prices. In other words, they substitute high value-added production for low value-added output.

Gasoline is a typical low value-added product. Because one brand is perceived to be much like another, competition is fierce and markups low. One reason is that the production process is relatively simple and a refiner does little to transform the product. With high value-added products, on the other hand, a firm may spend millions of yen or dollars coming up with unique products it can sell at high prices, a process involving highly paid labor for the development effort. Aircraft are an example of such a product.

As already noted, low value-added products, including refined petroleum products, have declined in relative importance. The aircraft and parts industry increased some, remaining at 0.2 percent of all employment but rising from 1.6 percent to 1.9 percent of all shipments of manufactured goods. Other high value-added products did even better. Semiconductors, for example, soared from 2.3 percent of all shipments to 3.7 percent; between 1981 and 1985 more than 150,000 Japanese were added to the payrolls of semiconductor firms.

Are petroleum refining, aircraft and semiconductors indicative of a shift going on in the Japanese economy toward more value-added production? Table 4 provides data to consider this question.

Table 4: Value-Added by Industry, 1981 and 1985

	Value-Added		Adjusted Value-Added	
	1981	1985	1981	1985
Food Products	30.3%	31.8%	19.0%	20.3%
Tobacco Products, Beverages and Feed	23.6	22.9	17.9	17.5
Textile Mill Products	40.0	37.2	19.2	19.9
Apparel and Made-up Textile Products	45.3	46.6	21.9	22.6
Lumber and Wood Products	30.9	34.2	15.4	17.7
Furniture and Fixtures	41.5	42.4	22.0	22.4
Pulp, Paper and Paper Products	28.1	31.0	16.5	18.8
Printing and Publishing	53.6	51.0	31.0	28.4
Chemicals and Related Products	68.8	38.7	43.9	30.0
Petroleum Refining	8.6	8.3	4.4	6.8
Plastic Products	33.6	35.9	19.6	21.9
Rubber Products	38.1	39.8	21.3	21.9
Leather and Leather Products	35.3	37.1	18.6	20.2
Nonmetallic Mineral Products	42.6	44.9	27.0	28.2
Steel	27.8	29.2	18.0	19.1
Nonferrous Metals	24.4	24.5	15.7	14.5
Fabricated Metal Products	41.8	42.2	23.2	23.3
Nonelectric Machinery	41.2	41.3	23.5	23.5
Electric Machinery	37.5	36.4	22.7	23.0
Transportation Equipment	26.7	27.0	15.7	16.2
Precision Instruments	39.1	41.9	19.8	23.1
Ordnance	49.6	43.7	14.0	19.0
Other	41.1	41.7	23.5	25.0
Total	32.6	34.1	19.8	21.1

Source: Ministry of International Trade and Industry, Census of Manufactures, 1985.

The revenues from selling a product can go toward one of several purposes: to pay for materials, to pay for labor, to replace depreciating equipment, to pay taxes, to repay borrowed funds or toward profit. Higher value-added production implies that a larger proportion goes toward labor (because

the workers are highly skilled and therefore more expensive) or toward profit (because the company faces less competition).

One way of measuring value-added is to divide total shipments into the sum of labor costs, interest payments and profit. The higher this figure, the higher the value-added. This number is shown in the first and second columns of Table 4. The problem with this procedure is that industries that use a lot of labor, even if it receives very low wages, end up with a high figure. While few economists would regard apparel as a high value-added industry, it has one of the biggest numbers.

An alternative procedure is to leave out the payments to labor. This procedure approximates per-unit profitability and should give an indication of the extent to which a firm successfully differentiates its products, enabling it to earn higher profits. Of course, this measure excludes the possibility that the firm may be adding value by employing highly skilled and well-paid workers. This figure, termed adjusted value-added, is reported in the second set of columns in Table 4. The numbers support the argument that the Japanese economy is moving toward higher value-added production. For example, adjusted value-added in food products rose from 19 percent to 20.3 percent between 1981 and 1985.

Comparing Industries

Table 5 shows the relative size of Japanese industries. Nonelectric and electric machinery together account for more than a quarter of all manufacturing employment and an equal percentage of value-added. Wages range from a low of Y1,621,000 per year ($6,811 at the average 1985 exchange rate of Y238=$1.00) in the apparel industry to Y4,068,000 ($17,092) in the transportation equipment industry. In motor vehicle production, which accounted for almost 80 percent of the employment in the latter industry, cash earnings averaged Y4,057,000 ($17,046). In 1988, with the yen averaging around 125 to the dollar, these figures would obviously be much higher in dollar terms.

The table also highlights the tremendous number of workplaces; even on a more disaggregated basis and only counting workplaces with more than four employees, the figures are impressive. In the motor vehicle and automotive parts industries there were 10,777 such locations in 1985; sewing machines were made in 591 places. There were 9,500 people, more than four times the number in 1981, making robots at 422 locations. And 3,000 people labored making Western-style umbrellas, many times the mere 75 employed nationwide making Japanese-style ones.

Table 6 gives a more detailed view of one key industry -- steel. Like manufacturing generally, output per worker is increasing in every part of the industry. While manufacturing as a sector produced much more with a constant number of workers, steel output increased modestly using fewer workers. (In constant yen, output increased 6.7 percent.) In some parts of the industry employment declines were fairly dramatic even over the relatively brief 1981-85 period shown. While these losses were by and large easily absorbed because the firms in question had other jobs for the workers in question, the figures raise questions about how more widespread structural shifts would be handled.

Table 5: Comparing Industries, 1985

(workplaces with four or more employees)

	Number of Workplaces	Employees	Percent of All Workers	Average Annual Cash Earnings (thousand yen)	Percent of Value-Added
Food Products	46,296	1,016,731	9.3%	Y2,339	7.2%
Tobacco Products, Beverages and Feed	6,056	139,767	1.3	3,309	2.2
Textile Mill Products	35,424	609,462	5.6	2,307	3.3
Apparel and Made-up Textile Products	30,750	539,538	5.0	1,621	1.9
Lumber and Wood Products	22,762	276,444	2.5	2,404	1.5
Furniture and Fixtures	17,375	221,663	2.0	2,566	1.3
Pulp, Paper and Paper Products	11,899	275,495	2.5	3,279	2.5
Printing and Publishing	29,544	515,213	4.7	3,921	5.0
Chemicals and Related Products	5,352	395,748	3.6	4,529	8.8
Petroleum Refining	1,010	37,697	0.3	5,031	1.2
Plastic Products	18,135	382,247	3.5	2,940	3.2
Rubber Products	5,682	165,315	1.5	3,239	1.3
Leather and Leather Products	5,650	76,509	0.7	2,279	0.4
Nonmetallic Mineral Products	21,191	465,483	4.3	3,142	4.3
Steel	6,855	388,357	3.6	4,643	5.7
Nonferrous Metals	4,377	163,392	1.5	3,907	1.7
Fabricated Metal Products	50,311	786,604	7.2	3,126	6.1
Nonelectric Machinery*	43,879	1,126,614	10.3	3,834	11.1
Electric Machinery	34,196	1,825,314	16.8	3,007	16.4
Transportation Equipment	15,521	961,590	8.8	4,068	13.6
Precision Instruments	7,905	261,784	2.4	3,137	2.0
Other	18,348	258,982	2.4	2,600	1.9
Total	438,518	10,889,949	100.0	3,184	100.0

*Includes ordnance.

Source: Ministry of International Trade and Industry, Census of Manufactures: Report by Industries, 1985.

Table 6: Components of the Steel Industry, 1985

	Percent of Steel Industry Employment	Average Annual Salary*	Four-Year Shipment Growth Rate	Four-Year Employment Growth Rate
Steel Produced in Blast Furnaces	33.2%	Y5,541	-0.9%	-6.9%
Steel not Produced in Blast Furnaces	1.4	4,479	-23.2	-29.8
Processed Rolled Steel	13.5	5,148	8.4	-3.0
Unprocessed Rolled Steel	14.0	4,417	0.9	-13.7
Surface-treated Steel	1.4	4,576	6.6	-23.8
Forged and Cast Steel	7.4	4,052	-1.7	-15.8
Pig Iron Castings	14.5	3,802	6.2	-8.5
Other Steel	14.5	3,500	16.0	1.2
Total	100.0	4,643	3.1	-8.0

*In thousands of yen.

Source: Ministry of International Trade and Industry, Census of Manufactures, 1985.

Importance of Small-Scale Manufacturing

Just because there are a lot of workplaces does not mean there are a lot of firms involved in manufacturing; conceivably these facilities could be operated by a relatively small number of firms. That is not the case, however. There is also a very large number of companies in Japan that manufacture, a total of more than 87,000 counting only those that employ at least 20 people.

The first two columns of Table 7 show the relationship between the number of firms and the number of workplaces. (These figures are less inclusive than in previous tables, referring to firms having at least 20 employees. They accounted for 75.4 percent of the employment reported in Tables 1-5.) As firms become larger, they operate in more locations. Firms that employ more than 5,000 people, for example, operate in an average of 10.9 workplaces. The smallest firms operate in only one.

The table also shows that just over half of all Japanese manufacturing workers are employed by firms having fewer than 300 employees and that these people are paid less than those working for larger firms. Bigger companies also contribute more than their share of value-added, although firms employing fewer than 1,000 still account for half of the total.

There were only 91 manufacturing firms in 1985 employing more than 5,000 workers, a figure that had dropped from 112 in the 1975 census of manufactures. (The comparable figure for the United States in 1987 was over 400 companies.) While in 1975 the biggest firms employed 19.7 percent of all production workers, by 1985 the figure had fallen to 16.2 percent. The number employed by such firms declined by 18.3 percent between 1975 and 1985, while the number employed

by firms having between 20 and 30 employees increased 55.7 percent. For firms employing at least 20 people, average employment dropped from 112.8 per firm in 1975 to 94.4 in 1985.

Table 7: Employment Data by Firm, 1985

Employment Level by Firm	Average Number of Workplaces	Percent of Employees	Cumulative Percent of Employees	Average Annual Cash Earnings (thousand yen)	Cumulative Gross Value-Added
20-29	1.0	11.4%	11.4%	¥2,628	6.7%
30-49	1.0	8.9	20.3	2,745	12.1
50-99	1.1	13.8	34.1	2,763	21.0
100-199	1.4	13.1	47.2	2,923	30.4
200-299	1.7	6.9	54.1	3,084	35.7
300-499	2.0	7.4	61.5	3,452	42.8
500-999	2.5	8.4	69.9	3,680	52.2
1,000-4,999	4.4	14.0	83.9	4,307	72.5
Over 5,000	10.9	16.2	100.0	4,838	100.0
Total	1.2	100.0	100.0	3,469	100.0

Note: Percentage totals may not add to 100 due to rounding.

Source: Ministry of International Trade and Industry, Census of Manufactures, 1985.

Other Developments

Many companies operate in more than one industry. Japan's Fair Trade Commission has found that the trend is accelerating. As Table 8 shows, the percentage of output of each firm accounted for by its "home" industry has been declining. Experts believe that, if anything, the era of the high yen has speeded up this process. Steel firms, for example, have come to believe that foreign demand for their products will continue to be weak and are therefore seeking new opportunities. NKK Corp. (formerly Nippon Kokan K.K.) is developing new biotechnology products and Nippon Steel Corp. is selling U.S.-made super-minicomputers to Japanese customers. While diversifying companies have high hopes for these ventures, their ultimate success remains in doubt, in part because new management techniques are required to run diversified firms.

Complicating life still more for management is another trend now picking up speed: overseas investment. While Americans are most familiar with Japanese manufacturing investment here (see JEI Report No. 21A, May 27, 1988), it is a worldwide phenomenon. In the long-run offshore production could lead to a significant loss of employment opportunities in Japan, although the investment is still too limited to have had an impact. In early 1986 foreign affiliates of Japanese manufacturing companies employed about 800,000 workers. Estimates vary, but Japanese manufacturers are estimated to produce between 3 and 5 percent of their output abroad (see JEI Report No. 5A, February 5, 1988). The percentage of their foreign sales produced abroad may be much higher; Matsushita Electric Industrial Co., Ltd. says that it is approaching its goal of

manufacturing 50 percent of the products it sells overseas at offshore facilities.

Table 8: Share of Sales in Home Industry

(percent in each fiscal year)

Home Industry	FY 1979	FY 1984	FY 1986
Food Products	96.1%	96.8%	97.0%
Textiles	66.3	60.3	57.1
Wood and Wood Products	86.1	72.8	68.8
Pulp and Paper	86.1	93.0	92.5
Printing and Publishing	99.9	100.0	88.3
Chemicals	88.4	88.7	84.6
Coal and Petroleum Products	99.2	99.7	99.2
Rubber Products	90.0	89.6	88.5
Nonmetalllic Mineral Produc	75.6	76.4	71.4
Steel	85.8	81.8	78.6
Nonferrous Metals	89.1	67.7	60.8
Fabricated Metal Products	91.5	90.9	90.0
Nonelectric Machinery	75.9	77.9	73.1
Electric Machinery	93.3	95.3	83.6
Transportation Equipment	79.4	77.0	79.0
Precision Instruments	59.1	45.1	37.6
Other Manufacturing	71.0	69.7	67.4
Average	86.7	84.5	80.2

Source: Japan Fair Trade Commission

Japanese firms are even beginning to import some of the products produced overseas, although the amounts are still small. Together with sales by American, European and Asian companies, manufactured imports have surged, reaching close to 50 percent of all imports in recent months and averaging 44.1 percent in 1987. As a group, the share of Asian countries exceeded that of the United States for the first time last year, capturing 28.2 percent of the market against 26.8 percent. Excluding extraordinary imports of gold from the United States in 1986, Japan's purchases of manufactures from this country were up 18.1 percent in dollar terms in 1987, compared to increases of 61.1 percent for the Asian newly industrialized countries and 47.8 percent for the European Community. The increases come against a backdrop of much lower manufactured imports in Japan than in other industrialized countries -- a gap that even with the recent increases Japan has not yet closed (see JEI Report No. 14A, April 8, 1988).

For Japanese manufacturers, manufactured imports from unaffiliated firms could represent a threat to their heretofore secure domestic business. For Japanese workers in the manufacturing sector, imports could also be a problem -- if not in terms of unemployment, then by narrowing their chances to do the kind of work they prefer to do.

All of these recent trends point to a convergence between the organizational structures of American and Japanese firms, with the latter doing most of the changing. With some differences, diversification in Japan is following the American effort of the 1970s; large-scale U.S. investment abroad occurred even earlier. Growing manufactured imports are also moving the structure of Japan's manufacturing sector toward that of the United States.

The automotive industry is a case in point. The U.S. industry expanded its overseas production capacity in the 1950s and 1960, a period during which Americans at first bought few cars produced overseas. In order to compete with increasing imports from non-affiliated companies such as Volkswagen AG, U.S. companies eventually brought in more cars from their overseas plants.

Today Japanese automotive makers are increasing production in the United States and elsewhere. In Japan itself, the imported car market is still small but the pattern is analogous to the earlier U.S. experience: European and American companies are selling cars in competition with products from the overseas factories or partners of Japanese firms. For years Chrysler Corp. has used its Dodge and Plymouth dealers to sell the products of its Japanese supplier, Mitsubishi Motors Corp., in which it has an equity interest. MMC in turn has a share of the Korean auto maker, Hyundai Motor Co., and industry analysts expect its dealers to soon start selling Korean cars in Japan.

Outlook

The Japanese manufacturing sector, long considered the force behind the country's economic juggernaut, continues a process of change. While the data are a little ambiguous, Japanese firms have been moving toward higher value-added production for some time. How well the manufacturing sector adapts to externally imposed changes, such as a currency that has doubled in value against the dollar in three years, will have a lot to do with future success. Largely hidden from the American view, which concentrates on Japan's giant multinationals, are thousands of smaller firms that employ most of the people who work in manufacturing. Their numbers and importance are increasing. Differences in firm size, coupled with different activities and levels of capital investment, have created diversity in the manufacturing sector. As Japanese firms expand their activities across more product lines and national boundaries, diversity will increase further. Those hoping that Japanese manufacturers are settling into a comfortable middle age will be disappointed but for many, in Japan and abroad, there will be new opportunities.

For further information, contact Douglas Ostrom.

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The views expressed in this report are those of the author and do not necessarily reflect those of the Japan Economic Institute.